

A CONSPECTUS OF NEEDLE RUSTS ON BALSAM FIRS IN NORTH AMERICA<sup>1</sup>

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The needle rusts of balsam firs form a group in which there has been considerable confusion. A study of herbarium specimens shows this, since collections under one specific name will in some instances have aecia on the current season's needles and in other cases on the needles of the previous season, or one year old. Field study has shown that the age of the needles on which aecia are found is of important diagnostic value, and not a single species is known in the Pacific Northwest with aecia normally on both the current season's and one-year-old needles, nor is any such occurrence elsewhere in North America reported in the literature. In fact, except for *Milesia pycnograndis* (Bell) Arth., the aecia of which occur on needles from two to six years old, the aecia of these rusts are practically confined to needles of one season. Some of these rusts are frequently encountered in the Pacific Northwest, and in order to get a clear picture the present knowledge of their relationships was tabulated and is presented here with the hope that it may be useful to others (Table 1).

TABLE 1.—A conspectus of needle rusts on balsam firs

Uredinia and Telia		Pycnia and Aecia		Age of needles with aecia	References to notes
Rust	Host	Rust	Abies host		
<i>Calyptospora columnaris</i>	<i>Vaccinium</i> spp.	<i>Peridermium columnare</i>	<i>amabilis</i> <i>balsamea</i> <i>concolor</i> <i>fraseri</i> <i>grandis</i> <i>lasiocarpa</i> <i>magnifica</i> <i>nobilis</i>	current season	(1)
<i>Calyptospora</i> sp.?	<i>V. macrophyllum</i>	<i>P. ornamentale</i>	<i>concolor</i> <i>grandis</i> <i>lasiocarpa</i> <i>nobilis</i>	1 year	(2)
<i>Melampsora humboldtiana</i>	<i>Salix</i> spp.	<i>Caeoma americana</i>	<i>balsamea</i> <i>concolor</i> <i>grandis</i> <i>lasiocarpa</i>	current season	

<sup>1</sup> In the preparation of this paper, publications of Dr. J. H. Faull and his students on the needle rusts of *Abies* have been freely consulted. Acknowledgment is also made to Dr. Faull for his helpful suggestions regarding the manuscript.

TABLE 1.—(Continued)

Uredinia and Telia		Pycnia and Aecia		Age of needles with aecia	References to notes
Rust	Host	Rust	Abies host		
<i>Melampsorella elatina</i>	<i>Cerastium</i> spp. <i>Stellaria</i> spp.	<i>Peridermium elatinum</i>	<i>amabilis</i> <i>balsamea</i> <i>concolor</i> <i>grandis</i> <i>lasiocarpa</i> <i>magnifica</i> <i>nobilis</i>	current season	(3)
<i>Pucciniastrum abieti-chamaenerii</i>	<i>Epilobium angustifolium</i> and other species	<i>P. pustulatum</i>	<i>amabilis</i> <i>arizonica</i> <i>balsamea</i> <i>concolor</i> <i>grandis</i> <i>lasiocarpa</i> <i>nobilis</i>	current season	(4)
<i>P. epilobii</i>	<i>E. adenocaulon</i> and other species	<i>P. pustulatum</i>	<i>balsamea</i>	current season	
<i>P. myrtilli?</i>	<i>Vaccinium</i> spp.	<i>Peridermium</i> sp. nov.	<i>amabilis</i>	1 year	(5)
<i>Hyalopsora aspidiotus</i>	<i>Phegopteris dryopteris</i>	<i>Peridermium pycnoconspicuum</i>	<i>balsamea</i>	2 years	
<i>Milesia pycnographis</i>	<i>Polypodium vulgare</i>	<i>P. pycnographis</i>	<i>balsamea</i>	2 to 8 years	
<i>M. polystichi?</i>	<i>Polystichum munitum</i>	<i>P. rugosum</i>	<i>amabilis</i> <i>grandis</i>	current season	(6)
<i>M. kriegneri</i>	<i>Dryopteris spinulosa</i>	<i>P. kriegneri</i>	<i>balsamea</i>	current season	(7)
<i>M. marginalis?</i>	<i>Dryopteris marginalis</i>	<i>P. marginalis</i>	<i>balsamea</i>	current season	(8)
<i>Uredinopsis copelandi</i>	<i>Athyrium cyclo-sorum</i> , <i>Felix bulbifera</i>	<i>P. balsameum</i>	<i>balsamea</i> <i>grandis</i> <i>lasiocarpa</i> <i>nobilis</i>	current season	
<i>U. mirabilis</i>	<i>Woodwardia areolata</i> , <i>Onoclea sensibilis</i>	<i>P. balsameum</i>	<i>balsamea</i>	current season	
<i>U. osmundae</i>	<i>Osmunda</i> spp.	<i>P. balsameum</i>	<i>balsamea</i>	current season	
<i>U. phegopteridis</i>	<i>Phegopteris dryopteris</i>	<i>P. balsameum</i>	<i>balsamea</i>	current season	
<i>U. struthiopteridis</i>	<i>Woodwardia virginica</i> , <i>Struthiopteris germanica</i>	<i>P. balsameum</i>	<i>balsamea</i>	current season	
<i>U. macrosperma</i>	<i>Pteridium aquilinum</i>	<i>P. pseudo-balsameum</i>	<i>amabilis</i> <i>grandis</i> <i>lasiocarpa</i> <i>nobilis</i> <i>venusta</i>	1 year	(9)

## Note 1

*Calyptospora columnaris* causes witches' brooms on *Vaccinium*.

## Note 2

Weir, J. R.: Observations on *Calyptospora columnaris* and *Peridermium ornamentale*. *Mycologia* **18**: 274-277, Pl. 34-35. 1926. Weir suggests in this paper that the telial form of *P. ornamentale* is *Calyptospora* sp.

*Peridermium ornamentale* at present is undoubtedly a composite species, because *Peridermia* with aecia on the current season's needles and others with aecia on the one-year-old needles are so named. While the rust is listed here as occurring on four species of *Abies*, this is done simply because three of these hosts have been recorded elsewhere. In the Pacific Northwest the writer has found *P. ornamentale* with the characteristic laterally-flattened aecia on *A. lasiocarpa* only, and field study indicates that it may be confined to this host. At Government Camp, Oregon, for example, where *A. lasiocarpa* has been found commonly infected for several seasons, the rust has never been found on *A. nobilis*, although this host is more abundant there than *A. lasiocarpa*. As far as the age of the attacked needles is concerned, *P. ornamentale* is reported here only as it occurs on the original host species, *A. lasiocarpa*.

## Note 3

*Melampsorella elatina* causes witches' brooms with deciduous needles on *Abies*.

## Note 4

In a paper read before the International Botanical Congress at Ithaca, New York, in August, 1926, Faull pointed out differences in the period of time from inoculation to emergence of the aecia between *Pucciniastrum abieti-chamaenerii* and *P. epilobii*. Since nothing is known concerning these two species on their aecial hosts in the West, the known *Abies* hosts for *Pucciniastrum pustulatum* have all been listed under *P. abieti-chamaenerii*, while only *Abies balsamea* has been given under *P. epilobii*.

## Note 5

Boyce, J. S.: A possible alternate stage of *Pucciniastrum myrtilli* (Schum.) Arth. *Phytopath.* **18**: 623-625, 1928. In this paper it is suggested that the possible aecial stage of *P. myrtilli* is a *Peridermium* on *Abies amabilis*.

## Note 6

Hotson, J. W.: Preliminary list of the Uredinales of Washington. *Pub. Puget Sound Biol. Sta. Univ. Wash.* **4**: 273-391, 1925. On page 293 Hotson

suggests the possible connection of *Milesia polystichi* and *Peridermium rugosum*.

Although the aecia of *P. rugosum* occur on the current season's needles, they appear in the fall or occasionally in the late summer, when the needles are morphologically about one year old.

#### Note 7

In North American Flora 7<sup>10</sup>: 686, 1925, Arthur states that the aecia of *Milesia kriegeana* occur on leaves two or more years old. In a letter of April 7, 1927, referring to the aecia of this species, J. H. Faull wrote, "They are found always on the needles of the current season." In Scotland, when the writer was shown a needle rust on *Abies pectinata*, which from field study seemed to be *M. kriegeana*, the aecia were confined to the current season's needles.

#### Note 8

*Milesia marginalis* Faull and Watson was published by Faull in an abstract of a paper entitled, "Fern rusts I. The genus *Milesia*," which appeared in the Proceedings of the Royal Society of Canada, May Meeting, 1925. In North American Flora 7<sup>10</sup>: 686, 1925, Arthur evidently includes *M. marginalis* with *M. kriegeana*, judging by the fern hosts given under the last-named species. In a letter of April 7, 1927, J. H. Faull wrote, "*M. kriegeana* and *M. marginalis* are entirely distinct species, distinguished from one another by several well-marked points."

#### Note 9

The rare bristlecone fir (*Abies venusta* (Doug.) Koch) is a new host for *Uredinopsis macrosperma*. The collection was made by H. G. Lachmund on January 6, 1926, at an elevation of 1500 feet on Pick Creek, headwaters of the Big Sur River, Monterey Co., California. F. P. No. 40467.

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